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2. Location of mountains, plains, and plateaux. Compare the continental arrangement of plains, plateaux, and mountains with that of North America. Is the arrangement of mountains and plains most advantageous for man's occupation? Had the location of mountain ranges been similar to that of North America, would it have been better for civilization? Had the great plateau belt been in the northern part of the continent, and the plains in the southern part, would it have been better for human habitation?

III. Drainage: Locate Arctic, Pacific, Atlantic, Indian, and Inland systems.

What effect have the drainage systems had upon the development of the continent? What river valleys of Eurasia have been "cradles" of early civilization? Why? Which are the most important rivers as highways at present? Which are most important to agricultural interests for irrigation? If the rivers of the Arctic system flowed south instead of north, would their value to man be increased or diminished? Why?

IV. Prevailing winds.
1. Influence of westerlies.
2. Influence of monsoons.
3. Influence of trades.

Expression: 1. Model in sand the continent of Eurasia; different drainage areas.

2. Draw in relief the map of Eurasia. Draw in color typical scenes of Eurasia.

References: Mill, *International Geography;* Stanford's *Compendium of Asia,* and also *Compendium of Europe;* Mill, *Realm of Nature;* Reclus, *Earth and Its Inhabitants, Asia, Europe.*

Pedagogic Questions: 1. In what grade or grades would you teach Eurasia?

2. How would you present it to a class of children?

3. What part would you select as of most importance to present to the pupils? Why?

4. Should history or geography lead in the selection of subject-matter?

Mathematics

George W. Myers

Pedagogic School

In planning a course of study for prospective teachers of mathematics, the important consideration is not to devise a new and better method of transferring the necessary truths and principles of mathematics from the text-book, or the teacher's mind, to the mind of the learner. Nor is it the devising of ingenious means of exemplifying the nature of numerical processes which should be of most concern to the teacher. This has indeed been so long the guiding principle of so much pedagogical work as to convince us that relief from the number bugbear is not to be found through it. It is this which has dragged the word "pedagogy" into discredit among those who are sincerely attempting improvement in number teaching.

Most of the school subjects have so little to do with each other, or with actual life, that they are very soon forgotten after graduation day. It has grown to be a common thing to hear the man of affairs decry the schools as of no practical worth, and the schoolman's attempt to parry the thrust by lauding the disciplinary and cultural value of studies does little to close the gap which yawns between the problems of the schoolroom and the problems of life. That proficiency in the work of the school is no guaranty of efficiency in practical affairs is strengthened by the current opinion that good teachers are usually very poor business men. How often do we hear, with mortification, from the successful man of affairs the assertion that his study of the real questions of life began after his school days were over. "One year after my graduation day," says a scholarly business man, "I had forgotten substantially all I had learned in school." The head of a great industrial concern recently wrote, "I am thankful I never had a high-school education, for my observation convinces me that it would have been a detriment to me in my practical work." Another says, "The high-school graduate feels that hard work is degrading."

Granting that all these statements are in a measure unwarranted, it cannot but be admitted that they are a symptom of what is coming to be a widely prevailing dissatisfaction with the results of school training. They indicate a feeling among the people, which is not to be eradicated by the elimination of political influence from school management; nor by the concentration of power and responsibility in the hands of the superintendents; nor even by learned attempts to lecture and exhort thinking people into the persuasion that the schools would be good enough if the "people would only keep their hands off" and let the experts solve the school problems. But we need to bear in mind that it is the spirit of the American people to meddle with matters which touch their interests so vitally as do the schools. They will not be dissuaded by educational authorities, born and bred under the system in vogue, from exercising what they deem to be the blood-bought right to criticise and interfere in the management of their own concerns. When they discern a weakness in the school system, and particularly when their own children have suffered from it, they are disposed to seek a remedy, and will even go to absurd extremes to secure it, if schoolmen do not hearken to them. Those who are intrusted with direct responsibility cannot afford to look with pedantic disdain upon the opinions of the enlightened public, by assuming that the fault lies wholly at the door of a short-sighted popular prejudice.

The enormous industrial development of modern times and the rapid strides of recent scientific advance are facts not to be lightly thrown aside by the school officer as irrelevant and debasing, but to be soberly and conscientiously dealt with. These two factors, which have been so powerful in determining the trend of modern life, constitute, directly or indirectly, the major part of the difference between barbarism and modern civilization. This being granted, it would seem that those intrusted with the management of elementary and secondary schools cannot much longer ignore them in the school problem. They are the two great sources whence the real need for mathematical proficiency springs. This indispensable necessity for mathematics has kept the study in school curricula through a season of the sharpest criticism ever directed against any subject; and as science and industry grow in importance in modern society, so must the claims of the mathematical subjects for a place in school work be proportionally strengthened. Training, culture, logic, etc., as ends of study can be secured as well from other subjects as from mathematics. Many other subjects, while reaching these ends, are indeed much richer in information than are the mathematical studies; but they do not meet the requirements of the physical and industrial world.

Furthermore, it is a great mistake to argue, as some have done, that but little mathematical knowledge is really needed for practical affairs. It is quite true that very little mathematical knowledge is really used by many practical men. It is equally true that immensely more is used by others. The extent to which these subjects are of practical value is probably more a question of ability and training than is the case in any of the other school studies. Every mathematical subject, as far advanced as calculus, inclusive, is needed in the study of industrial problems, and there is scarcely a known branch of the science which is not called into requisition by the modern physical sciences. Many of the most significant questions of modern social and industrial life must remain forever apart from the mental experience of him who does not possess the mathematical key. Many other lines of scientific study must be forever closed to such a person.

The extent of one's need for mathematics is synonymous with his ability to see things under a quantitative aspect—with his power to discern the abstract in the concrete. Some persons are much more highly endowed in this respect than others. Something more than pure mathematical knowledge, or than pure physical knowledge, is required to make the need for mathematics felt. Both kinds of knowledge may even be had without insuring to the possessor a feeling of this need. Both are *necessary* but not *sufficient* conditions to the implanting of this need. The mental act involved in the co-ordination of the two knowledges—in the sensing of the abstract in the concrete—in the mental experience involved in consciously submerging from view the qualitative attributes of things and the simultaneous holding in consciousness of the quantitative attributes—these are the *sine qua non* of an appreciative feeling of the need for mathematics. This faculty can and must be trained through its normal exercise. It may and should be exercised from the beginning of the number work. It must not be exercised through the solution of artificial and unintelligible problems, intended to exemplify abstract relations and operations, the nature of which is unknown and unknowable in the terms of the pupil's experience with things.

Whenever a problem really calls for the application of mathematics, the nature of the problem determines the method of its teaching. Artificial devices are then quite unnecessary, if not positively harmful. In so far as they withdraw the energy of the mental machinery from the act of abstraction, they are actually weakening to the student. Compared with the skill which enables one to take the mental step from the numbered thing to the abstract number, and vice versa, facility in the manipulation of operations and processes is a very subsidiary part of mathematical training. Facility in handling operations will outrun skill in numerical abstraction, if we succeed in enriching our mathematical courses in really practical matter, and the necessity for artificial devices to trip the student's attention will vanish. The former will come as a by-product in securing the latter. But this will require a thoroughgoing reorganization of mathematical teaching, and must, of course, be brought about slowly.

I. The class will write out and present plans for teaching number classes of the first four grades, giving especial attention to practical problems. Experiments with beams; laws of the lever; simple surveying exercises, etc., are topics upon which plans may be written.

II. The discussion and criticism of these plans.

III. The exercises given under the heading Pedagogic School, COURSE OF STUDY for January, pp. 429-431, will be begun.

IV. The solution of numerical exercises which arise in nature study, physics, and manual training.